EXPLORING THE DIVERSIFICATION DISCOUNT: A FOCUS ON HIGH-

TECHNOLOGY TARGET FIRMS

THESIS

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AFIT/GCA/ENV/03-01

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THESIS

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Abstract

When firms choose to acquire others, those acquisitions can either be considered diversifying or non-diversifying. Whether the firm diversifies or not has been shown to affect the post-acquisition performance of that firm. Past merger and acquisition (M&A) research has identified a "diversification discount" when firms diversify through M&A activity. However managers continue to diversify, posing the question, "Why do firms continue to diversify in the face of research indicating negative post-acquisition performance"? The answer may be found in that much of the past research has treated all acquisitions the same by analyzing a wide cross-section of acquisitions from industries of all types. This assumption may be wrong, as not all acquisitions are the same.

The present research attempts to build on past research by analyzing only a single segment of M&A activity—the high-technology industry between the years 1994 and 1998. In addition, this study differs from past research by analyzing firm post-acquisition performance over a longer three-year period. The present research did achieve significant results that may help eliminate some of the clouds over diversification's true impact on M&A activity. A "diversification discount" was identified by the present research, confirming the findings of much of the past M&A literature.

EXPLORING THE DIVERSIFICATION DISCOUNT: A FOCUS ON HIGH-
TECHNOLOGY TARGET FIRMS

I. Introduction

The trend over time is that surviving firms acquire other firms, thereby resulting
in more diversified firms. For example, the proportion of the largest 500 U.S. industrial
firms that were substantially diversified more than doubled between 1949 and 1974 from
30 to 63 percent (Rumelt, 1982). In recent times, this merger and acquisition (M&A)
activity has continued to increase and set new records every year between 1994 and 2000
(Wall Street Journal, 2001). At the end of the 1990s market boom, more than $1.7
trillion worth of merger and acquisition activity occurred in the U.S. (Wall Street Journal,
2002). More is at stake as well, as the value of the merger transactions have increased
(Wall Street Journal, 1997). If these larger merger transactions perform negatively, the
stock market and individual investors may be impacted in an even more detrimental
fashion.

By completing an acquisition, acquiring firms either diversify into new areas or
remain focused in existing areas of business. Firms can remain focused in the same
business by completing horizontal acquisitions. Non-diversifying horizontal acquisitions
involve target firms in the same industry as the bidder, with similar products and
competencies (Ross, Westerfield, & Jordan, 1998). A horizontal acquisition may take
advantage of economies of scale to lower management and overhead costs by reducing
the resources needed to run the merged company. On the other hand, diversifying

acquisitions result from both vertical and conglomerate mergers. These occur when the

target and bidder operate in different stages or steps of the production process (e.g., such

as a paper producer acquiring a logging company) or when the target and bidder have no

relation to each other (e.g., such as General Electric's purchase of NBC) respectively

(Ross, Westerfield, & Jordan, 1998). These acquisitions can create economies of scope

or reduce risk by diversifying into businesses with different economic cycles. This study

will not distinguish between the two types of diversifying acquisitions, vertical and

conglomerate; instead, only the distinction between non-diversifying and diversifying

acquisitions will be considered.

Research has identified several rationales for diversification including, but not

limited to:

1. Increased market power that can facilitate predatory pricing and reciprocal
   buying and selling with customers and suppliers (Palich, Cardinal, & Miller,
   2000)
2. Firms with significant free cash flows can invest them by acquiring businesses
   to derive greater returns and to discourage future takeover attempts (Hitt et al,
   1998)
3. To create more flexibility in capital formation—a diversified firm can access
   external funding for expansion, or shift capital within its portfolio to do so
   (Palich, Cardinal, & Miller, 2000)
4. Reduction in the diversified firm's overall risk by combining businesses that
   have financial flows different from each other (Palich, Cardinal, & Miller,
   2000)
5. By acquiring firms with similar core competencies or related resources a
   diversified firm can take advantage of economies of scope (Hitt et al, 1998;
   Rumelt 1982)

Managers typically justify diversifying acquisitions with these reasons in mind and the

ultimate goal of increasing shareholder value. However, a majority of past research has

identified a "diversification discount" in firm value that may occur after a firm

diversifies. Either the costs of diversification equal or outweigh the benefits of diversification, or methodological problems have kept researchers from observing the realization of diversification benefits.

Motivation

Much research has been conducted on firm post-acquisition performance. Most conclude that diversification from M&A activity does not improve a firm's performance; instead it creates a "diversification discount" (e.g., Agrawal, Jaffe, & Mandelker, 1992; Berger & Ofek, 1995; Anand & Singh 1997; Mason & Goudzwaard 1976; Lang & Stulz 1994; Campa & Kedia, 2002). Despite the large amount of findings that present a negative correlation between diversification and performance, many firms continue to diversify. A small amount of research suggests that some firms benefit from diversification but that, on average, most do not (Loughran & Vijh, 1997; Campa & Kedia, 2002).

A paradox seems to exist. Why do diversifying acquisitions persist in the face of evidence that they do not improve firm performance? The answer may be found in the fact that prior research typically treats all acquisitions the same. However, not all acquisitions are the same (Bower, 2001) and past research that analyzes a wide cross-section of acquisitions might not be suitable. Therefore, this study distinguishes itself by isolating the research sample to high-technology industries. Campa and Kedia (2002) argue that diversifying firms are often responding to a technology change, which may explain the lower performance of diversifying firms. Limiting the sample of this study to firms in high-technology industries better controls for the negative impact of technology uncertainty on firm performance and provides a more controlled sample for measuring

the impacts of diversification on performance. In addition, most existing research

focuses on short-term measures of firm performance, which may not adequately predict

long-term performance under conditions of uncertainty (e.g., Chatterjee, Lubatkin &

Schulze, 1999; Loderer & Martin, 1992; Lubatkin & Shrieves, 1986) such as that found

in high-technology industries. Another contribution is the present study examines the

diversifying firms' abnormal stock return over a longer, three-year period. A final

contribution is that this research compares the performance of diversifying firms with

firms completing non-diversifying acquisitions within the same industry; thereby

controlling for any performance consequences of merely completing an acquisition.

Scope

    This study examines a sample of public firms that acquired a high-technology target

firm between 1 January 1994 and 31 December 1998 with a market capitalization of

$10M or greater. Post acquisition performance is measured using Jensen's alpha-- a

measure of abnormal return (Jensen, 1968). In order to develop an empirical model that

can isolate diversifying and non-diversifying firm performance and to eliminate biases,

the following control variables are used:

1. Value of the transaction

2. Firm profitability prior to acquisition

3. Form of acquisition

4. Method of accounting for the merger

5. Industry environment

6. Year of acquisition

7. Acquisition experience

<u>Research Objectives</u>

This research has two objectives:

1. Define, document and utilize past research relevant to post-acquisition firm performance, to identify diversification's effect and other factors significant in examining firm post-acquisition performance.

2. Determine if diversifying firms perform differently from non-diversifying firms after an acquisition.

<u>Layout</u>

This thesis contains five chapters. Chapter one introduces and motivates the research. Chapter two consists of a literature review examining relevant published research with an effort to summarize it. Chapter three describes the methodology of the data analysis, explaining the sample, the variables, and the regression performed. Chapter four will discuss the results and discussion of the research. Chapter five includes a summary of the present research, future research suggestions, and possible implications for the Department of Defense (DoD).

II. Literature Review

This chapter begins with a summary of past literature findings of merger and acquisition (M&A) rationale, high-technology firms, and conclusions of M&A impact. Next, past research will be used to justify the performance measure for this research. Explanation of the independent variable and the control variables follows and will also utilize past research.

Literature Review of Past Research

An extensive list of past merger and acquisition (M&A) research exists. Each study has contributed to what is known about M&A activity. This review identified over forty studies in order to explore those relevant to diversification and its impact on firm performance. The articles obtained were from a variety of management journals, such as: *Strategic Management Journal, The Journal of Finance, Academy of Management Journal.*

M&A Rationale

Most managers' main purpose in acquiring other firms is to create more wealth for their shareholders (Carper, 1990). Acquiring firms' managers present many diverse reasons justifying their decision to acquirer targets with increasing shareholder wealth as the end goal.

By far, the most frequently cited motivation for acquisitions is to create synergy and capitalize on economies of scale and/or scope with the acquired firm (e.g., Palich, Cardinal, & Miller, 2000; Rumelt, 1982; Berger & Ofek, 1995; Comment & Jarrell, 1995; Lubatkin et. al., 2001; Hayward, 2002; Anand & Singh, 1997; Beattie, 1980; Hitt et. al.,

1998; Berkovitch & Khanna, 1991). Managers argue that the synergy created by the acquisition allows the commonalities or complementarities between the two firms to create a combined value greater than the value of the two independent firms (Hayward & Hambrick, 1997). Synergy can result as the two firms share knowledge and skills at many different levels such as, development, production, management, and marketing. Specifically, economies of scope might manifest as shared manufacturing facilities, while economies of scale might manifest as joint production of components (Farjoun, 1998). Synergistic goals are most often associated with horizontal mergers, as they are most often associated with similarities between firms. Similarities between firms allow the synergies to develop, while reducing costs as the combined firm's operations are streamlined. Together, these synergies equate to greater operating efficiency and result in increased firm performance (Berger & Ofek, 1995).

Increased market power is another motivation for M&A activity (Palich, Cardinal, & Miller, 2000; Lubatkin et. al., 2001; Hayward, 2002; Anand & Singh, 1997; Beattie, 1980; Hitt et. al., 1998). After M&A activity, the acquirer has a greater market share and improved ability to set prices (Hitt et. al., 1998; Lubatkin et. al., 2001). With a larger market share, the new firm can use predatory pricing to drive competitors out of the market (Palich, Cardinal, & Miller, 2000). In addition, the acquired firm has one less competitor, directly increasing market power (Lubatkin et. al., 2001, Hayward, 2002). Again, the market power motivation is most often used in horizontal type mergers, as market power is associated with a single industry or product.

Better resource allocation, or more flexible capital formation, is another M&A rationale (Palich, Cardinal, & Miller, 2000; Berger & Ofek, 1995; Comment & Jarrell,

1995; Hitt et. al., 1998). Managers argue that M&A activity in larger firms, with greater internal capital resources, allows better allocation of those resources. Accessing internal rather than external capital allows managers to shift resources more efficiently to other business segments, thereby enhancing firm performance (Palich, Cardinal, & Miller, 2000; Berger & Ofek, 1995; Comment & Jarrell, 1995). A manager with a diversified firm, or one seeking a more diversified firm, would use this rationale as uncorrelated segments allow for the resource shifting (segments of a horizontal firm would most likely need capital at similar times in the business cycle).

Managers seeking a more diversified firm also use risk reduction as a motivation (Palich, Cardinal, & Miller, 2000; Beattie, 1980; Lubatkin & O'Neill, 1987). Managers use the same justification stockholders use to diversify their portfolios. By combining businesses or segments with less than perfectly correlated performance demands, firms can insulate their profits from adverse shifts in the demand for their products, thereby reducing systematic risk (Palich, Cardinal, & Miller, 2000; Beattie, 1980; Lubatkin & O'Neill, 1987). Risk reduction then facilitates better performance. By definition, this risk reduction can only occur in diversified firms.

Directly pertinent to the present research, firms also pursue M&A activity as a substitute for research and development (R&D) (Bower, 2001; Hayward, 2002; Chaudhuri & Tabrizi, 1999). R&D is vital to high-tech companies as their products often become obsolete in a matter of months (Chaudhuri & Tabrizi, 1999). Companies that need technical knowledge can either purchase it or develop it in-house (Chaudhuri & Tabrizi, 1999). Shorter product life cycles necessitate shorter development periods (Bower, 2001). Acquisition can be used in place of in-house R&D to develop a product

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quickly (Bower, 2001). Chaudhuri and Tabrizi (1999:125) noted that several companies have been able to "cut their time to market in half through a successful acquisition." M&A allows high-tech firms to quickly obtain the R&D that is vital to their industry.

Managers justify M&A use with the ultimate goal of increased firm performance. Synergistic efficiencies are most often mentioned as motivation; however, many more exist. In addition, substituting M&A for in-house R&D is specific to high-technology firms and is most relevant to the present research.

Diversification's Impact

The majority of existing research suggests that diversification is a poor management strategy for the acquirer. Many approaches have been taken to discover diversification's impact on firm post-acquisition performance. Literature has compared diversified firms operating in several industries to portfolios of independent firms and found that the diversified firms consistently were valued less than a diversified portfolio (Mason & Goudzwaard, 1976). Berger and Ofek (1995) compared the value of entire diversified firms to the sum of their respective segments and concluded that diversified firms have 13-15 percent less value. Anand and Singh's (1997) approach focused on a declining industry and again found that consolidation, the opposite of diversification, was a better strategy. In addition, Agrawal, Jaffe, and Mandelker (1992) quantified the acquirer's post-acquisition performance loss over five years at close to 10 percent. Research that focused on the degree of diversification and firm performance concluded that "related" diversification could have a positive impact; however, non-related diversification consistently displays a negative impact (Lang & Stulz, 1994; Rumelt, 1982; Palich, Cardinal, & Miller, 2000). This is only a short list of research identifying a

"diversification discount" that accompanies firm performance after a diversification strategy is pursued.

A smaller body of research has identified a positive impact of diversification on post-acquisition performance. Lubatkin (1987) employed two new measures of firm performance and found that acquisitions lead to permanent gains in stockholder value. After extensively controlling for the firms' characteristics, or endogenity (i.e., size, profitability, environment, etc.), Campa and Kedia (2002:1760) concluded "diversification is a value enhancing strategy for those firms that actually pursue it…" Research focusing on the degree of diversification has concluded that if the target is related to the acquirer, "related" diversification can have a positive impact on firm performance (e.g., Lang & Stulz, 1994; Rumelt, 1982; Palich, Cardinal, & Miller, 2000). It is important to add that research has also identified that target shareholders typically benefit from firms that diversify though acquisition (Lubatkin, 1987; Loughran & Vijh, 1997).

The contrasting findings of past M&A research are evidence that the impact of diversification remains clouded. Most of the research that assumes a black and white approach between diversifying and non-diversifying acquisitions finds that diversification has a negative impact on post acquisition performance of the acquirer creating a "diversification discount." However, others find positive post-acquisition performance, especially when the degree of diversification is accounted for in the analysis. In addition, much of existing research has a potential limitation as it uses cross-sectional samples and assumes all acquisitions are the same. The inconclusive body of past research leaves

room for the present research to add to the understanding of diversification's impact on firm performance using a sample that controls for the "type" of acquisition.

High-Technology Focus

  The conflicting conclusions of past M&A research leave room for better understanding. M&A activity has been shown to have both positive and negative impact on an acquirer. The conflicting conclusions may be a result of the cross-sectional perspective of past research, because not all acquisitions are alike (Bower, 2001). Therefore, the present research attempts to control for this fact by focusing on one business sector, high-technology.

  A minimal amount of past research has focused on single industries. Farjoun (1998) focused solely on the manufacturing industry in an extensive effort to determine relatedness' impact on diversification. Fowler and Schmidt (1989) also focused on the manufacturing industry and examined the impact of six factors on the post-acquisition performance of 42 tender offers. In an effort to study an industry in decline, Anand and Singh (1997) limited their research to the U.S. defense industry. Ramaswamy (1997) focused on the U.S. banking industry in order to determine when horizontal mergers succeed. However, Lubatkin et al. (2001:344) is the only research found that explicitly remarks that limiting research to only one industry controls for one source of variance of cross-sectional studies, "noncomparable industries."

  High-technology industries are different from others; Chaudhuri and Tabrizi (1999:124) claim high-technology industries are "fundamentally different." High-technology firms rely on products that have very short life times. A microprocessor may become obsolete in a few months as opposed to a manufacturing industry product such as

a car that is viable for possibly a decade. Long-term success in a high-technology industry is contingent on a firm's ability to maintain superior technical know-how and innovation. This technical expertise resides in the firm's employees, which again distinguishes high-technology corporations. Unlike firms in other industries, high-technology firms suffer when they lose key technical employees (Chaudhuri & Tabrizi, 1999). High-technology industries must be the sole focus of research that involves them, as these key differences make high-technology industries fundamentally different from others.

Precedents exist for M&A research to focus on a specific type of industry. In addition, high-technology industries have intrinsic properties that others do not. Comparing firms in a cross-sectional analysis creates additional variance that may lead to inconclusive results. Therefore, this study focuses only on high-technology M&A activity.

Performance Measure

A performance measure must be chosen to illustrate the acquisition's effect on firm performance. Several measures have been utilized in past research. One measure, return on assets (ROA), has been used (e.g., Park, 2002; Ramaswamy, 1997; Mason & Goudzwaard, 1976, Hitt et. al., 1998) as it is a simple and straightforward calculation (profit divided by assets) that allows a comparison to be made between the firm's pre and post-acquisition performance. However, ROA has a fault in that it is impacted by the method of accounting for the acquisition (i.e., pooling or purchase). Using purchase accounting, ROA will decrease if a premium was paid for the target because the combined post-acquisition assets will be larger due to increased goodwill and/or assets,

the denominator in ROA (King, 2003). Past research has also used a measure called "Tobin's q" (e.g., Anand & Singh, 1997; Lang & Stulz, 1994; Berger & Ofek, 1995; Servaes, 1991). Lang & Stulz (1994:1249) express Tobin's q as, "the present value of future cash flows divided by the replacement cost of tangible assets." Some of its advantages include: it incorporates the capitalized value of the benefits of diversification, and it is not influenced by time periods as it focuses on only a point in time (Lang & Stulz, 1994). However, Tobin's q is based upon what the market thinks the benefits from diversification will be, whether or not they are real (Lang & Stulz, 1994). This assumption that the market efficiently reacts, in an unbiased way, instantly at a point in time to an acquisition, has motivated researchers to seek other performance measures. Both ROA and Tobin's q leave room for a better performance measure.

In order to measure the performance of mutual funds relative to the rest of the market, Jensen (1968) created a unit of measure known as "Jensen's alpha." The measure was the intercept of the line created by regressing an investment's performance with the performance of the market using a benchmark over time. Other studies have since used the measure, or a form of it, to determine the post-acquisition performance of an acquirer relative to a general benchmark of the market (i.e., S&P 500, DJIA) (e.g., Beattie, 1980; Hoskisson et al, 1993; Farjoun, 1998; Hoskisson, Johnson, & Moesel, 1994, Lubatkin, 1987). Jensen's alpha is a straightforward calculation that can be used over a time period that gives an objective measure of a firm's actual performance. The present research will utilize Jensen's alpha to determine the average difference between the monthly return of the acquiring firm's stock and the S&P 500 to calculate a firm's post-acquisition performance, or abnormal return.

The present research seeks to distinguish between diversifying and non-diversifying M&A activity to establish its effect on firm performance. It follows many others that have categorized the amount of diversification that has taken place. Rumelt (1974; 1982) categorized the amount of diversification into seven categories: single business, dominant vertical, dominant constrained, dominant linked-unrelated, related constrained, related linked, and unrelated business. These categories were based a firm's specialization ratio, related-core ratio, related ratio, and vertical ratio—all measures Rumelt devised himself. The Herfindahl index computed from the sales of a firm by segment has also been used as the summation of the squared values of sales per segment as a fraction of total firm sales (Lang & Stulz, 1994; Comment & Jarrel 1993; Beattie 1980). However, most existing research uses some form of the Standardized Industrial Classification (SIC) codes (e.g., Berger & Ofek, 1995; Agrawal, Jaffe, & Mandelker 1992; Hoskisson, et al., 1993; Hayward & Hambrick, 1997). SIC codes range from two to four digits, with greater industry specificity as the digits progress. The present research follows past research as it distinguishes between diversifying and non-diversifying M&A activity using SIC codes; also known as related and non-related, or conglomerate and non-conglomerate (Berger & Ofek, 1995; Agrawal, Jaffe, & Mandelker, 1992). An acquisition will be considered non-diversifying if the two firms have the same four digit SIC codes. If the firms' codes are defined to any less than four digits (i.e., the firm operates in multiple four digit industries), or differ from each other, the acquisition will be considered diversifying. Hoskisson et al. (1993) has demonstrated the construct validity of an objective categorical measure of diversification using SIC

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codes; therefore, this research uses SIC codes to determine if an acquisition is diversifying or non-diversifying.

<u>Control Variables</u>

Past research has shown that many other variables can affect firm post-acquisition performance. It is believed that not only does the acquisition itself affect performance, but the conditions under which it took place and how it was conducted can have a significant impact. Therefore, the impact of these additional variables is also taken into account.

Acquiring Firm Environment. The acquirer's environment, measured by three measures (munificence, dynamism, and complexity) may have a significant impact on firm performance (e.g., Dess & Beard, 1984; Sharfman & Dean, 1991; Keats & Hitt, 1988). The measures attempt to describe three different aspects of a firm's environment, and are included to account for the acquisition's environmental properties.

Munificence is a measure used to describe the availability of resources in an environment correlated with the environment's ability to sustain growth in a given industry (Dess & Beard, 1984; Sharfman & Dean, 1991; Keats & Hitt, 1988). A more munificent environment is one with more available resources and has shown stable growth. Accordingly, munificence is characteristically assumed to have a positive net effect on firm performance (Decarolis & Deeds, 1999).

Dynamism is a measure of an industry's environmental instability or volatility (Dess & Beard, 1984; Sharfman & Dean, 1991; Keats & Hitt, 1988). A more dynamic environment exhibits more instability and therefore more risk. It is believed that firms in dynamic environments will make an effort to diversify into less dynamic ones in order to

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achieve greater stability, thereby leading to higher performance and less risk (Keats &
Hitt, 1988).

Complexity is a measure of heterogeneity of the firm that is necessitated by the
industry's environment (Dess & Beard, 1984). Sharfman and Dean (1991:683) describe
it as "the level of complex knowledge that understanding the environment requires." In
general, fragmented industries are considered more complex than concentrated ones
(Keats & Hitt, 1988). Fragmented industries have resources and power relatively widely
distributed among numerous firms resulting in more competition. Therefore, firms
operating in less complex environments are expected to outperform those in more
complex environments.

Form of Acquisition. Two forms of acquisition exist, mergers and tender offers;
both have been extensively controlled for in past research (e.g., Agrawal, Jaffe, &
Mandelker, 1992; Rau & Vermaelen, 1998; Loughran & Vijh, 1997). Mergers occur
when an acquisition is negotiated directly with a target's managers without public
disclosure—until a deal is announced. Contrastingly, tender offers involve public bids
made directly to the target's shareholders who are then given a period of time to tender
their shares to the acquirer for compensation, typically cash. Tender offers must remain
open to other bidders for some minimum period, allowing them to make bids and often
creating competition for the target.

Most research has concluded that the form of acquisition has an impact on firm
performance. Acquiring with tender offers has a positive effect on post-acquisition
performance relative to acquiring with mergers (e.g., Rau & Vermaelen, 1998; Loughran
& Vijh, 1997). In addition, Berkovitch and Khanna (1991) used game theory to develop

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a model describing when the two forms should be used; they concluded that synergy gains for a tender offer should be higher than for a merger and should result in better post-acquisition performance.

Method of Accounting. Two forms of accounting for an acquisition existed during the time period of the sample, purchase and pooling. When acquirers use purchase accounting, the acquired assets of the target are entered at the effective price paid (Ravenscraft & Scherer, 1987). On the other hand, pooling accounting is used when acquirers enter the assets of the target at their pre-acquisition book value and the difference paid for the firm is either debited or credited to the acquirer's stockholders' equity account (Ravenscraft & Scherer, 1987). Past research had identified purchase accounting to be negatively correlated with post-acquisition performance as it may result in higher premiums paid for a target (Ravenscraft & Scherer, 1987). It should be noted that as of July 2001, pooling accounting is no longer allowed by the Financial Accounting Standards Board (FASB), as purchase accounting is considered more accurate.

Method of Payment. The method of payment used in the acquisition can also impact firm performance. Acquirers can pay for a target using cash, stock, or a combination of both. Past research concludes that acquisitions paid with cash outperform those paid with stock (e.g., Rau & Vermaelen, 1998; Loughran & Vijh, 1997). Rau and Vermaelen (1998) explain that managers who believe their firm is overvalued are more likely to pay with stock than cash, thus creating a predisposition for negative performance. The method of payment and form of acquisition have been found to be significantly correlated (Ravenscraft & Scherer, 1987). Tender offers generally involve

cash payment, while mergers are more likely to be paid for with stock (Rau &

Vermaelen, 1998; Agrawal, Jaffe, & Mandelker, 1992). Due to the correlation between

form of acquisition and method of payment, the present research only controls for the

form of acquisition.

Year of Acquisition. The year an acquisition takes place may impact post-

acquisition performance. It is commonly accepted that some years are better for the

market than others. Similar to Hayward and Hambrick (1997), the present research

controls for the year the acquisition was completed.

Firm Profitability. A firm's profitability prior to an acquisition may impact post-

acquisition performance. A firm more profitable prior to an acquisition is more likely to

experience continued high performance. Past research has controlled for acquiring firm

profitability (Campa & Kedia, 2002). The present research controls for both acquirer and

target profitability.

Value of Transaction. Target size may affect post-acquisition performance. For

example, it may be easier to integrate smaller firms (Alvarez & Barney, 2001; Clark &

Ofek, 1994). Therefore, the present research controls for target size with the value of the

transaction. The larger the transaction, the larger the target.

Acquisition Experience. Acquisition experience may impact post acquisition

performance. However, past research has observed conflicting results. Fowler and

Schmidt (1989) found that an acquirer's acquisition experience had a significant and

positive impact on that firm's post-acquisition experience. On the other hand, Hayward

(2002) found the opposite in an extensive study looking at acquisition experience; he

determined that greater acquisition experience resulted in significant and negative firm

post-acquisition performance. The present research controls for acquisition experience of the acquirer as it may have an impact on post-acquisition returns.

Summary

M&A activity has been extensively studied, yet the impact of diversification on acquiring firm performance remains unclear. Conflicting findings of past research may be the result of the wide cross-sections of M&A activity that assumed all acquisitions are the same. However, acquisitions are not all the same (Bower, 2001); therefore, it is not surprising that prior cross-sectional research that assumes homogeneity of M&A samples exhibits inconsistent results. Building on past research, the present research attempts to add to the body of knowledge by studying how diversification affects post-acquisition performance after high technology targets are acquired. High-technology acquisitions have been identified as different from other acquisitions in general (Bower, 2001; Chaudhuri & Tabrizi, 1999). By limiting the sample to high-technology acquisitions, the present research attempts to isolate the impact of diversification on post-acquisition performance, while controlling for the effects of variables found significant in prior research.

III. Methodology

This chapter begins by describing the sample used for the present research. It then details the variables and analysis used to create a multiple regression model to determine diversification's impact on firm post-acquisition performance.

<u>Sample</u>

For the present research, an initial sample of 380 high-technology target acquisitions was identified from the *Securities Data Corporation* (SDC) mergers and acquisitions database that occurred from 1 January 1994 to 31 December 1998. This timeframe was selected because it is relatively recent and controls for the known impacts of the business cycle on acquisition activity by ensuring all performance measurement occurred in a period of favorable market conditions (Ramanujam & Varadarajan, 1989; Lubatkin et. al., 1997). The following industries were considered high-technology industries by the present research: chemicals (SIC 28), computer equipment (SIC 35), electronics (SIC 36), aerospace (SIC 37), instruments (SIC 38), communications (SIC 48), and software and services (SIC 73). Limiting the merger and acquisition (M&A) sample to only one industry (high-technology) is justified to help eliminate cross-sectional analysis problems that may have contributed to conflicting results in past M&A research. In addition, the sample was limited to targets with a market capitalization of at least $10M to ensure the target firms would have a significant impact on the acquirer (e.g., Ravenscraft & Scherer, 1987; Finkelstein, 1997).

Two further limitations were placed on the initial sample. First, acquisitions were eliminated from the sample if data for defining the research variables was not located in

the SDC database or *COMPUSTAT* (a database of financial, statistical, and marketing

information). Second, the Center for Research on Security Prices (CRSP) located at the

University of Chicago Graduate School of Business maintains a comprehensive

collection of standard and derived security data for the NYSE, AMEX and Nasdaq Stock

Market. This database had to contain additional data on the firms in order to calculate

several of the research variables. After deleting acquisitions with missing data, the final

sample contained 325 data points.

Dependent Variable: Jensen's Alpha

To measure the post-acquisition performance of the acquirer, Jensen's alpha

(Jensen, 1968) will be used. Prior research has examined post-acquisition performance

over a three-year period (e.g. Ramaswamy, 1997). A three-year examination period

allows for the full effect of the acquisition to be observed on firm performance (Lubatkin

et.al., 2001). For each month following the acquisition ($t = 1$ to 36), the following

regression model was calculated:

$$R_{it} = \alpha + \beta(R_{mt}) + \varepsilon_{it}$$

where:
R_{it} is the monthly rate of return of firm i during month t
α is Jensen's alpha
β is a firm's stock price variance relative to the market's variance
R_{mt} is the monthly rate of return of the market benchmark during month t
ε_{it} is the random error term

The regression intercept, Jensen's alpha, measures the average difference between

the market benchmark's return and the return of the firm, or abnormal return (Alexander

& Francis, 1986). The S&P500® index served as the market benchmark. Individual firm

stock and market benchmark monthly rates of return are based on data from the *CRSP*

database. A positive Jensen's alpha value indicates the firm performed better relative to the market, with the converse true as well. Intuitively, a value of zero indicates the firm's stock performance relative to the market was not different.

Independent Variable: Diversification

The present research uses diversification as the independent variable to determine its effect on post-acquisition performance. Target and acquirers' Standardized Industrial Classification (SIC) codes were obtained from the *COMPUSTAT* database to the 4-digit level. If the acquirer and target had the same 4-digit SIC codes, the acquisition was considered a non-diversifying one. If the acquirer and targets' SIC codes were different at any level, the acquisition was considered to be diversifying. Non-diversifying acquisitions were coded with a 1, while diversifying ones were coded with a 0.

Control Variables

Additional variables have been shown to impact post-acquisition performance (e.g., Fowler & Schmidt, 1989; Campa & Kedia, 2002; Keats & Hitt, 1988; Hayward & Hambrick, 1997; Rau & Vermaelen, 1998; Loughran & Vijh, 1997) and will be controlled for in the present research. First, the *value of the transaction* in millions of dollars as reported in the SDC database was used to control for the size of the target. Second, both acquirer and target firm past *profitability*, or return on sales (ROS) measured in the prior year was controlled for. ROS was calculated by dividing net income by sales. Third, the *form of acquisition* (tender offer or merger) was controlled for with a dichotomous dummy variable. Mergers were coded with a 0, while tender offers were coded with a 1; data was obtained from the SDC database. Fourth, another dichotomous dummy variable was used to control for the *method of accounting* (pooling

or purchase). Acquisitions that used pooling accounting were coded with a 0, while those that used purchase accounting were coded with a 1; again, data was obtained from the SDC database. Fifth, three measures of the *industry environment* (i.e., munificence, dynamism, and complexity) were used to control for the firms' environment. These measures were obtained following procedures used by Keats and Hitt (1988) (see Appendix B). Sixth, *acquisition experience* was controlled for by including a continuous variable equal to the sum of the acquirers' past acquisitions over the previous three years. Finally, the *year of the acquisition,* or time period*,* was controlled for using a polychotomous dummy variable with the year 1994 as the base. The year of the acquisition was obtained from the SDC database.

Analysis

A multiple regression model was created with Jensen's alpha as the dependent variable, diversification as the independent variable, and the control variables. During the analysis it was determined that two outliers existed using a plot of the studentized residuals. These outliers were greater than four standard deviations from zero and were removed. In addition, the three assumptions of regression: normality of the residuals, independence of the sample, and constant variance were validated using the Shapiro-Wilk goodness of fit test, the Durbin-Watson test, and the Breusch-Pagan test respectively. A further discussion of the validation of the three regression assumptions is included in Appendix A.

IV. Results and Discussion

This chapter presents the results of the multiple regression analysis of the high-technology target sample of 323 acquisitions (two outliers were removed during the analysis). The model created produced statistically significant findings. In addition, this chapter will include a discussion of the results obtained.

Results

Table 1 contains the means, standard deviations, and correlations for all of the variables included in the model. Acquirer prior profitability was positive with a value of 0.816, meaning the acquiring firms, on average, made a slight profit. Target profitability was -48.295; however, this value exhibited a large standard deviation (615.714), making interpretation difficult. The average value of the transactions included in the sample was $865.872 million. This was higher than the cutoff of $10 million ensuring the target acquisitions were significant to the acquirers. Only 18.2% of acquisitions were performed with tender offers, the majority being mergers. Purchase accounting was used in 56.6% acquisitions as opposed to pooling accounting. With averages of 1.183, 1.034, and 0.854, the acquirers' environmental measures, in general, relate that the environments were increasing in munificence, becoming more dynamic, and decreasing in complexity, respectively (Note: higher complexity values denote lower environmental complexity). On average, the acquirers had performed 3.615 prior acquisitions in the previous three years. Between 1994 and 1998, the proportions of acquisitions performed were 8.3%, 17.8%, 17.2%, 23.7%, and 32.6% respectively. Finally, 38.5% of the

acquisitions in the sample were considered non-diversifying, meaning the majority were diversification-oriented acquisitions.

Some of the correlations in the table are notable. Those variables correlated with Jensen's alpha and diversification are most interesting. Acquirer prior profitability, 1995, 1996, and 1998 are all significantly ($p < 0.01$) correlated with Jensen's alpha. In addition, the form of acquisition, method of accounting, and acquirer munificence are all significantly ($p < 0.01$) correlated with diversification. As expected the variables for the years were also highly correlated with each other. Finally, Jensen's alpha and diversification themselves were significantly ($p < 0.05$) correlated. Although only notable, these correlations add insight into how the variables in the model interact and relate with each other.

Table 1: Variable Means, Standard Deviations, and Correlations[a]

Variable	Mean	Std Dev	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Jensen's Alpha	0.004	0.024	1													
2 Acquirer Profitability	0.816	5.277	0.198**	1												
3 Target Profitability	-48.295	615.714	-0.024	-0.079	1											
4 Value of Transaction[b]	865.872	3043.667	-0.058	-0.019	0.018	1										
5 Form of Acquisition	0.182	0.386	-0.037	-0.007	0.030	-0.032	1									
6 Method of Accounting	0.566	0.496	0.126*	0.079	-0.043	-0.089	0.379**	1								
7 Acquirer Munificence	1.183	0.132	0.099	0.009	0.067	-0.089	-0.139*	-0.198**	1							
8 Acquirer Dynamism	1.034	0.040	-0.015	0.046	0.028	-0.037	0.053	0.070	0.089	1						
9 Acquirer Complexity	0.854	0.256	0.119*	0.104	0.040	-0.043	-0.011	-0.057	0.016	-0.156**	1					
10 Acquirer Acquisition Experience	3.615	4.792	0.043	-0.044	-0.006	-0.023	0.006	0.007	0.070	-0.077	0.124*	1				
11 1995[c]	0.178	0.383	-0.142**	-0.115*	0.008	-0.065	0.009	0.032	-0.180**	0.064	-0.145**	-0.147**	1			
12 1996[c]	0.172	0.378	-0.165**	-0.063	0.032	0.040	-0.044	0.011	0.066	0.028	0.127*	-0.016	-0.212**	1		
13 1997[c]	0.237	0.426	-0.043	-0.080	0.026	-0.036	0.002	-0.063	0.086	0.022	0.005	0.027	-0.260**	-0.251**	1	
14 1998[c]	0.326	0.470	0.322**	0.243**	-0.063	0.085	0.011	0.035	0.009	-0.079	0.051	0.115*	-0.327**	-0.317**	-0.388**	1
15 Diversification	0.385	0.487	0.141*	0.020	0.054	0.116*	-0.159**	-0.188**	0.218**	-0.050	-0.100	-0.137*	-0.038	-0.087	0.057	0.045

[a] n = 323 acquisitions

[b] $M

[c] Dummy variable with 1994 as base year; mean represents the proportion of acquisions completed that year

* $p < 0.05$

** $p < 0.01$

Multiple regression analysis identified both the control variables that had significant impact on Jensen's alpha, or post-acquisition firm performance, and the independent variable's (diversification) effect. The model obtained an adjusted R-squared value of 0.156, with an F-ratio of 5.252 ($p < 0.0001$); therefore, the model could explain almost 16% of the variance within the data, and had at least one variable with a statistically significant impact. Table 2 contains the multiple regression results.

Table 2: Standardized Multiple Regression Results

Variable	Standardized Regression Coefficient
Acquirer Profitability	0.091[#]
Target Profitability	-0.005
Value of Transaction	-0.062
Form of Acquisition	-0.078
Method of Accounting	0.180**
Acquirer Munificence	0.076
Acquirer Dynamism	0.013
Acquirer Complexity	0.119*
Acquirer Acquisition Experience	0.008
1995	-0.029
1996	-0.085
1997	0.027
1998	0.248**
Diversification	0.138**
R^2	0.193
Adjusted R^2	0.156
F	5.25

[a] n = 323
[#] p < 0.10
[*] p < 0.05
[**] p < 0.01

Four control variables had significant impacts on the independent variable, in addition to two others that were correlated but not highly significant. To begin with, the profitability of the acquirer in the year prior to the acquisition had a positive and significant impact on Jensen's Alpha ($p = 0.078$). The form of acquisition variable showed that acquisitions performed with mergers were positively correlated with post-acquisition performance; however, this was not highly significant ($p = 0.149$). In

addition, purchase accounting was shown to have a positive and strong significant impact on Jensen's Alpha ($p = 0.001$). Two of the three acquirer industry environment variables were positively associated with post-acquisition performance. Munificence with a p-value of 0.158 was not highly significant; however, low complexity was with a p-value of 0.022. The dummy variable for year 1998 was the last of the control variables to have a significant impact. It was positive with a p-value of 0.006. No other variables had an impact on Jensen's Alpha. The significance of these control variables illustrates the importance of controlling for their impact on the performance of the acquirers after the acquisitions.

Integral to the present research, the independent variable had a highly significant impact on firm post-acquisition performance. The act of not diversifying during an acquisition was positively correlated with Jensen's Alpha ($p < 0.01$). The diversification variable's ability to help explain variance in the model establishes its impact on the performance of the acquirers after they have completed an acquisition.

The regression model proved to be valid. Variance inflation factor (VIF) scores indicated multicollinearity within the independent and control variables did not exist and was not a problem. In addition, the necessary assumptions of regression (i.e., independence of the sample, normality of the residuals, and constant variance) were satisfied by the model. The multiple regression output and a further discussion of the assumptions are included in Appendix A.

Discussion

Several variables in the model had an impact on post-acquisition performance measure. Diversification and four control variables were significant. A discussion follows.

As expected, acquirer profitability in the year prior to the acquisition played a role in determining if the acquisition would become a success or failure. Acquirers that were more profitable prior to an acquisition were more likely to experience positive post-acquisition performance. Managers of profitable firms, most likely, have a better understanding of how to operate firms more efficiently than managers of less profitable ones. It is reasonable to assume that this wisdom translates itself to the new company formed by the acquisition, allowing for continued higher profitability. In addition, a firm operating with less profitability is more likely to carry on the problems making it less profitable to the newly created company. Companies operating less profitably most likely have a larger amount of debt than more profitable ones. These less profitable companies often increase their debt when purchasing a target, often creating firms that cannot perform well due to their high debt burden. The present research has shown that acquirer prior profitability can impact the post-acquisition performance of the created firm in similar manner to which it was prior to the acquisition, either positive or negative.

The method of accounting used for the acquisition was shown to have a strong impact on the post-acquisition performance of the new firm. Acquirers that used purchase accounting performed better after the acquisition than those that used pooling accounting instead. Pooling accounting has been shown to be significantly correlated with higher target premiums (Ravenscraft & Scherer, 1987). Further, higher target premiums have been determined to negatively impact post-acquisition performance

(Hayward & Hambrick, 1997). The lower performance of acquisitions that used pooling accounting can most likely be attributed to the negative effects created when high premiums are paid for targets. It is suggested these negative effects result as the new firm struggles to recoup the high price it paid for the target and from lack of attention as the firm manager focuses on the new business while possibly neglecting the core one (Hayward & Hambrick, 1997). Acquisitions that use purchase accounting are less likely to have high premiums. This lack of high target premiums most likely yields better post-acquisition performance. An important note to add is that as of July 2001, the Financial Accounting Standards Board no longer allows pooling accounting to be used. A possible implication of this decision is the absolute use of purchase accounting may lead to more in-depth scrutiny of M&A activity.

The present research also identified the industry environmental measure complexity had a significant impact on post-acquisition performance. As expected, acquisitions in less complex, or more concentrated, environments were shown to outperform those that were not. Sharfman and Dean (1991) found that managers in more complex environments devote more resources in order to make their companies more flexible and to increase their "information-processing capability." In addition, Keats and Hitt (1988) suggest that low complexity supports growth, as the lack of complexity in the environment allows for more resources to be devoted towards growth. More complex environments require firms to devote more resources in order to deal with the difficult business environment. Therefore, it can be reasoned that the better performance of acquisitions in less complex environments may be due to the larger amount of resources solely devoted towards optimizing the newly created firm performance.

The dummy control variable for year 1998 was the final control variable to have a significant impact on the post-acquisition firm performance. Acquisitions performed during 1998 were more likely to experience positive post-acquisition performance than acquisitions performed in the previous four years. This can be attributed to the high-technology market boom that began in 1998 and continued throughout the late nineties. In general, high-technology firms had abnormally positive performance during the boom. The high performance of these firms during this time was reflected in the significance of the 1998 dummy variable.

Most important to the present research, the independent variable, diversification, was shown to have a significant and negative effect on firm post-acquisition performance. Firms that acquired targets in other areas of business or industries performed worse than those that acquired similar targets. This finding concurs with other research, thereby confirming that a "diversification discount" exists (e.g., Agrawal, Jaffe, & Mandelker, 1992; Berger & Ofek, 1995; Anand & Singh 1997; Mason & Goudzwaard 1976; Lang & Stulz 1994). When firms used acquisitions to diversify into high-technology industries, value was lost.

The fact that diversification destroys value is not easily understood, and that is possibly why managers persist with diversification in the face of negative research. If managers were aware of what factors destroy firm value in acquisitions, they would surely take steps to avoid them. This CEO hubris (overconfidence) and the high premiums paid for targets have been cited as possible reasons why diversification fails to create value. Hayward and Hambrick (1997) found that CEO hubris and high premiums were correlated with negative post-acquisition performance. They theorized that CEO

overconfidence leads to higher premiums paid for targets, which creates poor conditions for acquisitions to succeed since the new overvalued corporation must deal with a high debt load.

Another explanation for the poor performance of diversifying acquisitions that may be relevant is the difficulty in effectively assimilating the target. Diversification attempts to bring together companies with fewer similarities. Integrating two companies with different cultures and strategies for management, production, advertising, markets, etc., may make assimilation more difficult in diversifying acquisitions. In contrast, related or non-diversifying acquisitions experience significantly higher post-acquisition performance partly because assimilation faces fewer challenges for related firms.

Summary

The present research identified a "diversification discount" for high-technology firms acquired between 1994 and 1998. This finding concurs with others that identified a diversification discount when large cross-sections, containing corporations in many different sectors, of acquisitions were examined. In addition, the present research also identified that four control variables (acquirer prior profitability, the method of accounting, environmental complexity, 1998) impact post-acquisition performance.

V. Conclusion

This chapter summarizes the methodology and results of the present research and thoughts for future analysis. In addition, possible Department of Defense (DoD) implications are presented.

<u>Research Summary</u>

The present research adds to the merger and acquisition (M&A) body of knowledge by examining 323 (two were removed as outliers) high-technology target acquisitions between 1994 and 1998 in order to determine diversification's effect on post-acquisition performance. By focusing only on high-technology targets, past problems associated with examining large cross-sections of firms were overcome. In addition, to ensure the full effect of the acquisition was observed, the present research observed the post-acquisition performance for three years. Jensen's Alpha (Jensen, 1968) was used as the dependent variable to measure firm performance (abnormal return) relative the S&P500®. Further, thirteen control variables were included in the analysis as they may also have an impact on the success or failure of an acquisition.

Diversification was observed to have a significant and negative impact on firm post-acquisition performance value, resulting in a "diversification discount" that concurs with past research (e.g., Agrawal, Jaffe, & Mandelker, 1992; Berger & Ofek, 1995; Anand & Singh 1997; Mason & Goudzwaard 1976; Lang & Stulz 1994). In addition, four control variables were significantly correlated with post-acquisition performance. Acquirer prior profitability, the use of purchase accounting as the method of payment,

and the year 1998 all had a positive impact, while environmental complexity had a negative one.

<u>Future Research</u>

Merger and acquisition activity has been extensively analyzed, yet much room still remains for further understanding. Acquisitions continue despite the large body of research suggesting they destroy firm value. The present research attempted to overcome one of the largest possible problems associated with past research in general, the large cross-sectional analysis. By not consistently distinguishing between diversifying and non-diversifying acquisitions, past research that identifies acquisitions underperform may be skewed by the lower performance of diversifying acquisitions that represent the majority of M&A activity in the present sample. If this notion is true, this suggests that past research findings may be better described as having documented the poor performance of diversifying firms.

The present research is exploratory in nature and additional research is warranted, as indicated by the low R-squared value. First, research could examine additional business segments, types of acquisition, and time frames. Second, research focusing on theoretical development and empirical testing of factors that would allow managers to make better decisions in selecting and integrating acquisition targets is needed. In addition to managers, the further understanding gained may allow stockholders to make better judgments of the future value of a company they have an interest in that is considering an acquisition.

Beginning in the mid nineties, defense firms embarked on a massive consolidation effort. It was explained that they needed to do so by then Secretary of Defense William Perry if they wished to survive the large defense spending reduction. In a recent article, Moran (2003) states, "What were thirty-three separate businesses in 1990 are five defense firms today." This consolidation was encouraged at the time, but may have resulted in a defense industrial base that fosters little competition for DoD contracts. Many point to the resulting small defense industrial base and express that few, if any positive benefits, resulted from this consolidation as fewer contractors now receive much more of the defense budget (Moran, 2003). However the present research suggests that the non-diversifying, or consolidation, M&A activity taken by the defense firms was probably the best option for them. The present research could argue that if these firms had diversified into the other industries they might be in worse financial shape than they presently are.

A recent Pentagon report (DoD, 2003) recommends that the Department of Defense categorize and analyze the firms within the defense industrial base in relation to five operational effects-based sectors: combat support, power projection, precision engagement, homeland and base protection, and integrated battlespace. This may serve as a catalyst to motivate current defense firms to focus on the effects-based sectors from which their capabilities will be evaluated in the future. The report describes that one way legacy defense firms may develop these new, or transformational, capabilities is by acquiring emerging defense suppliers. The results of the present research, and much of the past M&A research, suggests firm performance may improve as the defense firms focus their businesses through M&A activity. However, King and Driessnack (*Forthcoming*) stress that because much of the impact of M&A activity is still poorly

understood, it would not be prudent for the government to have a pro-active policy towards M&A activity.

Summary

The present research accomplished its original objectives. It first identified and documented past research that was pertinent to this study. This documentation provided a baseline of past M&A research used to develop the current model of acquisition performance. The present research then added to the body of M&A understanding by taking a direct look at the high-technology segment of M&A activity and identifying diversification's impact on it. Diversification was found to have a significant negative impact on firm post-acquisition performance, while controlling for the type of acquisition.

Appendix A: Regression Output and Assumptions

<u>Regression Output</u>

All outputs were obtained using Jump 5.0. The regression results include both R-squared and adjusted R-squared values, an ANOVA table, variable (parameter) estimates, variable p-values, and VIF scores. Figure 1 contains the regression output.

Response st J alpha

Actual by Predicted Plot

st J alpha Predicted P<.0001 RSq=0.19
RMSE=0.8849

Summary of Fit

RSquare	0.19271
RSquare Adj	0.156015
Root Mean Square Error	0.884884
Mean of Response	-0.02183
Observations (or Sum Wgts)	323

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	14	57.57012	4.11215	5.2517
Error	308	241.16982	0.78302	Prob > F
C. Total	322	298.73994		<.0001

Parameter Estimates

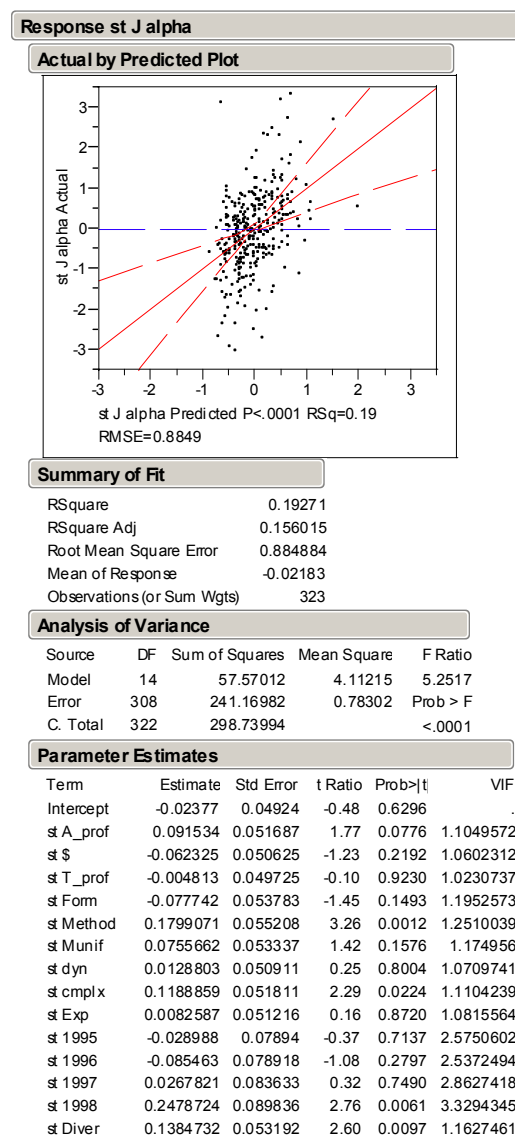| Term	Estimate	Std Error	t Ratio	Prob>|t|	VIF
Intercept	-0.02377	0.04924	-0.48	0.6296	.
st A_prof	0.091534	0.051687	1.77	0.0776	1.1049572
st $	-0.062325	0.050625	-1.23	0.2192	1.0602312
st T_prof	-0.004813	0.049725	-0.10	0.9230	1.0230737
st Form	-0.077742	0.053783	-1.45	0.1493	1.1952573
st Method	0.1799071	0.055208	3.26	0.0012	1.2510039
st Munif	0.0755662	0.053337	1.42	0.1576	1.174956
st dyn	0.0128803	0.050911	0.25	0.8004	1.0709741
st cmplx	0.1188859	0.051811	2.29	0.0224	1.1104239
st Exp	0.0082587	0.051216	0.16	0.8720	1.0815564
st 1995	-0.028988	0.07894	-0.37	0.7137	2.5750602
st 1996	-0.085463	0.078918	-1.08	0.2797	2.5372494
st 1997	0.0267821	0.083633	0.32	0.7490	2.8627418
st 1998	0.2478724	0.089836	2.76	0.0061	3.3294345
st Diver	0.1384732	0.053192	2.60	0.0097	1.1627461

Figure 1: Regression Output

<u>Regression Assumptions</u>

Independence of the dataset was objectively verified using the Durbin-Watson (DW) test. The model obtained a DW p-value of 0.574, much greater than the alpha value of 0.05, indicating that the dataset was independent at a 95% confidence level. Figure 2 is the Durbin-Watson test output.

Durbin-Watson			
Durbin-Watson	Number of Obs	AutoCorrelation	Prob<DW
2.0233579	323	-0.0194	0.5744

Figure 2: Durbin-Watson Test Output

The assumption requiring a normal distribution of the residuals was tested two ways. A plot of the studentized residuals clearly illustrates that the distribution of the residuals is normal indicated by the 'bell shaped' curve. In addition, objectively, the Shapiro-Wilk (SW) goodness of test fit obtained a p-value of 0.336. The (SW) p-value greater than 0.05 ($p = 0.336$) indicates that at a confidence level of 95% a normal distribution fits the distribution of the residuals. Figure 3 includes this data.
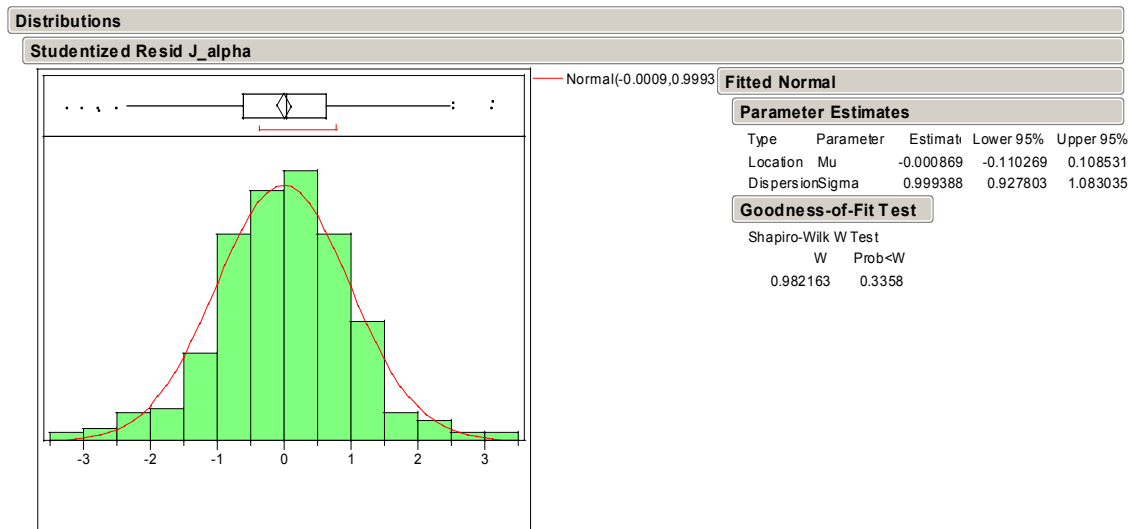
Figure 3: Studentized Residual Distribution & Shapiro-Wilk Test Output

Constant variance of the model was also examined two ways. First a plot of the residuals versus predicted values of Jensen's alpha was created. This plot is Figure 4. From this plot it is clear that no pattern exists, leading one to believe that the assumption of constant variance is valid. In addition, the Breusch-Pagan test was employed to objectively test the assumption (Neter, 1996). The test yielded a *p*-value of 0.990, again confirming that at a 95% confidence level the assumption of constant variance. Figure 5 contains the output used for the Breusch-Pagan test.
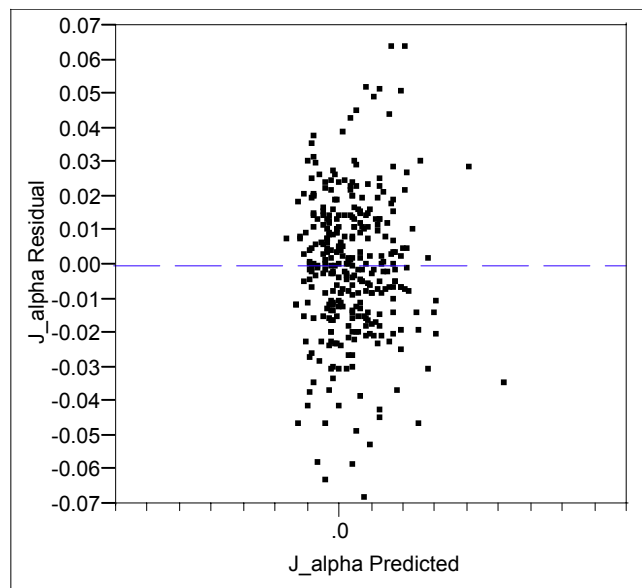
Figure 4: Residual vs. Predicted Plot

Table 3: Breusch-Pagan Test Table

Constant Variance Analysis (Breusch-Pagan Test)

Full Model without outliers	
SSE of model	0.13629147
SSR of residual^2 model	0.00001252
# of columns	15
n	323
df	14
BP value	4.68792617
p-value	0.98969935

Appendix B: Calculations for Environmental Measures

The main advocate of this research provided all three environmental measures. However, a brief discussion of how they can be obtained is included. These calculations are taken from and described further in Keats & Hitt (1988).

<u>Munificence</u>

The value used to describe the munificence was derived from two equations that accounted for high-technology industry sales and high-technology industry profit for the five years prior to the acquisition. High-technology industry sales and profit data were obtained from the *COMPUSTAT* database. Using simple regression, the slope coefficients of these lines were combined and then divided by two. The equations are below:

$$Y_t = \beta_0 + \beta_1 t + \varepsilon_t$$

where:
Y_t is high-technology industry sales for year t
β_0 is the regression intercept
β_1 is the regression slope coefficient
t   is the year t
ε_t is the random error term

$$X_t = B_0 + B_1 t + e_t$$

where:
X_t is high-technology industry profit for year t
B_0 is the regression intercept
B_1 is the regression slope coefficient
t   is the year t
e_t is the random error term

$$M = [\beta_1 + B_1] / 2$$

where:
M   is the measure of high-technology munificence observed for the prior five
         years
β_1 is the industry sales regression slope coefficient
B_1 is the industry profit regression slope coefficient

Dynamism

Dynamism was computed using the standard errors of each regression slope

coefficient from the sales and profit equations above. The two values were combined and

then divided by two. The standard error equation of a simple regression model is below

as well as the dynamism equation.

$$s = \sqrt{[SSE / (n - 2)]}$$

where:
SSE   is the sum of squared error for the regression model
n   is the number of data points in the model, i.e., degrees of freedom

$$D = [s_y + s_x] / 2$$

where:
D   is the measure of high-technology dynamism observed for the prior five
    years
S_y is the industry sales regression standard error
S_x is the industry profit regression standard error

Complexity

Complexity is a measure of heterogeneity of the firm that is necessitated by the

industry's environment (Dess & Beard, 1984). The calculations to obtain the complexity

measure are much more complex than the munificence and dynamism ones, and will not

be described. For a full discussion regarding the mechanics, see Keats & Hitt (1988).

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Vita

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14. ABSTRACT

When firms choose to acquire others, those acquisitions can either be considered diversifying or non-diversifying. Whether the firm diversifies or not has been shown to affect the post-acquisition performance of that firm. Past merger and acquisition (M&A) research has identified a "diversification discount" when firms diversify through M&A activity. However managers continue to diversify, posing the question, "Why do firms continue to diversify in the face of research indicating negative post-acquisition performance"? The answer may be found in that much of the past research has treated all acquisitions the same by analyzing a wide cross-section of acquisitions from industries of all types. This assumption may be wrong, as not all acquisitions are the same.

The present research attempts to build on past research by analyzing only a single segment of M&A activity—the high-technology industry between the years 1994 and 1998. In addition, this study differs from past research by analyzing firm post-acquisition performance over a longer three-year period. The present research did achieve significant results that may help eliminate some of the clouds over diversification's true impact on M&A activity. A "diversification discount" was identified by the present research, confirming the findings of much of the past M&A literature.

15. SUBJECT TERMS
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